

CLAIMS

What is claimed is:

1. A dilute aqueous cleaner and residue remover comprising:
from 0.02% to 0.18% by weight of a fluoride-containing compound selected from the group consisting of ammonium fluoride, alkylammonium fluorides, ethanolamine fluoride, ammonium bifluoride, alkylammonium bifluorides, or a mixture thereof;
from 20% to about 40% by weight water;
from 59% to 85% by weight total of an amide and an ether solvent,
from 0.2% to 5% by weight of an acid selected from sulfamic acid, phosphonic acid, a soluble phosphonic acid derivative, or mixture thereof; and
from 0.2% to 5% by weight of an alkanolamine.
2. The dilute aqueous cleaner and residue remover of claim 1, comprising:
from 0.02% to 0.18% by weight of a fluoride-containing compound selected from the group consisting of ammonium fluoride, alkylammonium fluorides, ethanolamine fluoride, ammonium bifluoride, alkylammonium bifluorides, or a mixture thereof;
between about 14% and 35% water by weight
between 10 and 40% of an amide;
between 20 and 59% of a glycol ether;
between 0.2% to 5% by weight of an acid selected from sulfamic acid, phosphonic acid, a soluble phosphonic acid derivative, or mixture thereof; and
between 0.2% to about 5% by weight of an alkanolamine.
wherein the pH is between 6 and 8.
3. The dilute aqueous cleaner and residue remover of claim 1 wherein the acid is sulfamic acid.
4. The dilute aqueous cleaner and residue remover of claim 2 wherein the acid is sulfamic acid.
5. The dilute aqueous cleaner and residue remover of claim 1 wherein the acid is phosphonic acid and at least one of amino tris methylenephosphonic acid, ethylenediamine tetra

methylenephosphonic acid, hexamethylenediamine tetra methylenephosphonic acid, diethylenetriamine penta methylenephosphonic acid, and 1-Hydroxy ethane diphosphonic acid.

6. The dilute aqueous cleaner and residue remover of claim 2 wherein the acid is phosphonic acid and at least one of amino tris methylenephosphonic acid, ethylenediamine tetra methylenephosphonic acid, hexamethylenediamine tetra methylenephosphonic acid, diethylenetriamine penta methylenephosphonic acid, and 1-Hydroxy ethane diphosphonic acid.

7. The dilute aqueous cleaner and residue remover of claim 1 wherein the acid comprises phosphonic acid.

8. The dilute aqueous cleaner and residue remover of claim 2 wherein the acid is comprises phosphonic acid.

9. The dilute aqueous cleaner and residue remover of claim 1 wherein the amide comprises N,N-Dimethylacetamide and the ether comprises Diethylene glycol monobutyl ether.

10. The dilute aqueous cleaner and residue remover of claim 2 wherein the amide comprises N,N-Dimethylacetamide and the ether comprises Diethylene glycol monobutyl ether.

11. The dilute aqueous cleaner and residue remover of claim 4 wherein the amide comprises N,N-Dimethylacetamide and the ether comprises Diethylene glycol monobutyl ether.

12. The dilute aqueous cleaner and residue remover of claim 11 comprising between 0.06 and 0.18% of ammonium fluoride.

13. The dilute aqueous cleaner and residue remover of claim 1 comprising between 0.06 and 0.15% of ammonium fluoride.

14. The dilute aqueous cleaner and residue remover of claim 1 further comprising between 0.01 and 0.1% of a chelator.

15. The dilute aqueous cleaner and residue remover of claim 1 wherein the pH is between 7 and 8.
16. The dilute aqueous cleaner and residue remover of claim 2 wherein the pH is between 7 and 8.
17. The dilute aqueous cleaner and residue remover of claim 1 wherein the pH is between 7.2 and 7.8.
18. The dilute aqueous cleaner and residue remover of claim 1 wherein the amide is selected from N-alkylacetamide, N,N-Dialkylacetamide, or mixture thereof, where the alkyl moieties are independently methyl- or ethyl-, and wherein the ether is selected from Diethylene glycol monobutyl ether, Diethylene glycol monopropyl ether, or mixture thereof.
19. The dilute aqueous cleaner and residue remover of claim 1 wherein the alkanolamine is an N-alkyl-substituted ethanolamine, an N,N-dialkyl-substituted ethanolamine, where the alkyl moieties are independently methyl- or ethyl-, or mixture thereof.
20. The dilute aqueous cleaner and residue remover of claim 3 wherein the alkanolamine is an N-alkyl-substituted ethanolamine, an N,N-dialkyl-substituted ethanolamine, where the alkyl moieties are independently methyl- or ethyl-, or mixture thereof.
21. The dilute aqueous cleaner and residue remover of claim 1 comprising between 20 and 30% of an amide, and between 40 and 55% of a glycol ether.
22. The dilute aqueous cleaner and residue remover of claim 4 wherein the pH is between 7 and 8.
23. The dilute aqueous cleaner and residue remover of claim 4 wherein the pH is between 7.2 and 7.8, and wherein the alkanolamine is an N-alkyl-substituted ethanolamine, an N,N-dialkyl-substituted ethanolamine, where the alkyl moieties are independently methyl- or ethyl-, or mixture thereof.

24. A dilute aqueous cleaner and residue remover consisting essentially of:
between 0.5% and 1% of ammonium bifluoride, ammonium fluoride, or mixture thereof,
between about 55% and 75% of one or more amide solvent;
water;
optionally between 0.001 and 0.5% of a chelator, and
an alkanolamine in an amount sufficient to have a pH of between 8 and 8.2.
25. A dilute aqueous cleaner and residue remover comprising:
between 0.5% and 1% of ammonium bifluoride, ammonium fluoride, or mixture thereof,
between about 55 and 75% of one or more amide solvents;
water; and
one or more amines in an amount sufficient to have a pH of between 8 and 8.2.
26. A method of manufacturing of cleaning a semiconductor substrate comprising
providing a semiconductor substrate comprising a low-K substrate with un-ashed resist or
incompletely ashed resist residue thereon;
providing a dilute aqueous cleaner and residue remover of claim 1; and
contacting the semiconductor substrate with the aqueous cleaner and residue remover for a
period and under a temperature sufficient to clean the substrate of resist and/or incompletely ashed
resist residue.
27. The method of claim 26 further comprising rinsing the substrate after cleaning, and
drying the substrate, wherein the dielectric constant of the low-k substrate after drying is within
0.002 of the dielectric constant before cleaning.
28. A method of manufacturing of cleaning a semiconductor substrate comprising
providing a semiconductor substrate comprising a low-K substrate with plasma-ashed residue
thereon;
providing a dilute aqueous cleaner and residue remover of claim 1; and
contacting the semiconductor substrate with the aqueous cleaner and residue remover for a
time and at a temperature sufficient to clean the substrate of residue.

29. The method of claim 28 further comprising rinsing the substrate after cleaning, and drying the substrate, wherein the dielectric constant of the low-k substrate is within 0.002 of the dielectric constant before cleaning.

30. A method of manufacturing of cleaning a semiconductor substrate comprising providing a semiconductor substrate comprising a low-K substrate having copper metal thereon and plasma-ashed residue thereon;
providing a dilute aqueous cleaner and residue remover of claim 1; and
contacting the semiconductor substrate with the aqueous cleaner and residue remover for a time and at a temperature sufficient to clean the substrate of residue.

31. The method of claim 30 further comprising rinsing the substrate after cleaning, and drying the substrate, wherein the dielectric constant of the low-k substrate is within 0.002 of the dielectric constant before cleaning.

32. A method of manufacturing of cleaning a semiconductor substrate comprising providing a semiconductor substrate comprising a low-K substrate having copper metal thereon and plasma-ashed residue thereon;
providing a dilute aqueous cleaner and residue remover of claim 25; and
contacting the semiconductor substrate with the aqueous cleaner and residue remover for a time and at a temperature sufficient to clean the substrate of residue.

33. The method of claim 32 further comprising rinsing the substrate after cleaning, and drying the substrate, wherein the dielectric constant of the low-k substrate is within 0.002 of the dielectric constant before cleaning.